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IDEAL POWER

A MONTHLY MAGAZINE

DEVOTED TO COMPRESSED AIR AND ELECTRICAL APPLIANCES

PUBLISHED THE FIFTEENTH OF EVERY MONTH.

CONVENTION DATES.

May, 1910—Ohio Society of Mechanical, Electrical & Steam Engineers, Cincinnati, Ohio.

May 3-4-5-6-7, 1910—International Railway General Foremen's Association, Grand Hotel, Cincinnati, Ohio.

May 10, 1910—The Air Brake Association, Indianapolis, Ind.

May 16-17-18, 1910—Railway Storekeepers' Association, Planters' Hotel, St. Louis, Mo.

May 24-25-26-27, 1910—International Boiler Makers' Association, at Clifton Hotel, Niagara Falls, Ont.

June 7-8-9, 1910—American Foundrymen's Association, Pontchartrain Hotel, Detroit, Mich.

The Foundry & Manfrs.' Supply Association, at Detroit, June 6 to 10, co-operating with American Foundrymen's Association.

June 7-8-9, 1910—American Brass Founders' Association, Pontchartrain Hotel, Detroit, Mich.

June 15-16-17, 1910—Master Car Builders' Association, Young's Million Dollar Pier, Atlantic City, N. J.

June 20-21-22, 1910—American Railway Master Mechanics' Association, Young's Million Dollar Pier, Atlantic City, N. J.

June 25-26, 1910—Railway Supply Manufacturers' Association, Young's Million Dollar Pier, Atlantic City, N. J.

July 26-27-28, 1910—Canadian Association of Stationary Engineers, Berlin, Ont.

August 16-20, 1910—International Railroad Master Blacksmiths' Association, Detroit, Mich.

September, 1910—International Union of Steam Engineers (biennial convention), Denver, Colo.

September 13-16, 1910—Roadmasters and Maintenance of Way Association, Chicago.

October 18, 1910—American Railway Bridge and Building Association, Fort Worth, Texas.

October 11, 1910—Railway Signal Association, Atlantic City, N. J.

October 10-11-12-13, 1910—American Boiler Manufacturers' Association, Auditorium Hotel, Chicago, Ill.

December 6-7, 1910—American Society of Mechanical Engineers, Engineering Societies Bldg., New York.

January, 1911—Toledo Society of Engineers, Toledo, Ohio.

January, 1911—Indiana Engineering Society, Indianapolis, Ind.

January, 1911—Illinois Society of Engineers and Surveyors, East St. Louis, Ill.

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Sad Memories.

First Woman (as band is passing)—"What makes you weep so bitterly?"

Second Woman—"I always weep when I hear music. My late husband used to blow the whistle at the factory?"

Electrical Industry.

The following estimate of the value of various electrical industries in the country during 1909 has been published, as follows:

Electrical apparatus	$275,000,000
Electric railways	475,000,000
Central stations	250,000,000
Telephone	250,000,000
Telegraphy	60,000,000
Isolated plant supply	75,000,000
Miscellaneous	50,000,000
Total	$1,435,000,000

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Compressed Air and Its Uses

Power Transmission and Vertical Transmission

Air is a gaseous mixture, mostly nitrogen and oxygen, and behaves as other gases at all ordinary temperatures. It resists compression with an equal tension, its tension increases when heated, and, in common with all matter, it occupies space to the exclusion of all other matter, *i. e.*, it is impenetrable so far as its actual substance goes.

To these properties is due the industrial value of compressed air.

The compression of air is attended with the evolution of heat, which introduces another mechanical difficulty when any considerable pressure is required. Air compressed to 200 pounds from atmospheric conditions at 60 degrees F. will have a temperature between 600 and 700 degrees F., and even much lower temperatures than this are troublesome. One remedy is to employ water jackets, but these are inadequate for extreme conditions, which gave rise to compressing by stages (sometimes as many as four) with cooling between, by passing the air through intercoolers. Often to cool the finally compressed air an after cooler is used, which dries the air by precipitating the contained moisture, making it better suited to its work, preventing freezing if the air is piped where it is exposed to cold temperatures.

The machines in most favor in this country today are those cooling the compressed air by intercoolers, aftercoolers and water jackets. Such are known as dry compressors. In them a small quantity of air is left in the compression chamber at the end of the stroke, which, upon return of the piston, expands again to atmospheric pressure before any fresh air is admitted. Being warm, the amount of new air it excludes is aggravated, hence the desirability of very small clearance space. In the best designs this space is between 0.2 and 1.0 per cent of the total cylinder volume.

In compressed air as an economic means of transmitting power considerable distances, there are two sources of loss—its fall of temperature in transit with corresponding loss of tension, and friction, which is believed to be partially offset by heating the air and restoring some of the lost tension. That compressed air may be transmitted long distances with moderate loss is shown in a 10-mile main in Paris, where there is a drop of only 16.4 lbs. from an initial tension of 92 lb.

Heat, which is so undesirable during the compression, is advantageous, if it can be applied to the air after transmission, for it increases the tension, and this is sometimes done in practice. The tension of

compressed air at 0 degrees F. is half again as great at 240 degrees. It is entirely practicable to reheat to 300 degrees F., and if the temperature initially is 60 degrees the increase in tension amounts to $\frac{240}{520.6}$, 240 degrees being the increase in temperature and 520.6 degrees the absolute initial temperature of 60 degrees above zero (absolute zero is 460.6 degrees F.).

The conversion of mechanical energy into the energy of tension is only accomplished, like other exchanges, at a loss. The object to be gained is twofold, transmission and distribution, and conversion into a form more suitable for the purposes in hand. Compressed air is an admirable means by which power may be transmitted long or short distances and then distributed to small machines, whether fixed or portable. It is also a wonderful means for the exclusion of water in engineering operations involving a contest with water. With machines a moderately high temperature may be used, but in pneumatic engineering the temperature must be kept at or near normal because workmen breathe it and labor in it. The reheater, then, has no place in this latter application, but the compressing and cooling apparatus have. It is important that the compressors be reliable, for a failure in the supply may mean death to workmen or at least suspension of operations.

Excavation in solid, impervious rock may be expensive and slow, but the penetration is very sure; but where the strata are soft or water bearing, new complications enter. The actual digging and removing the soil can frequently be done with orange peel grab buckets or other excavators apart from the presence of workmen at the point of excavation, and the surrounding soil may be prevented from caving in by using the open caisson. If the object is securing a footing for piers and the like, the digging may be stopped upon reaching solid rock, or if piles are to be used, they may be driven when the caisson has reached an advantageous depth. Concreting may be done through the water and the whole structure be brought up above the surface without necessitating the presence of workmen within the caisson, subsequent to penetration below the water level, if at all.

It is often necessary or advisable, however, to have workmen on the spot and to lay concrete in the dry. In securing footings for such structures as the piers of the Brooklyn Bridge or the foundation columns of the Singer Building tower, it is well to know absolutely that the very soundest stratum has been reached and that the masonry or concrete has been laid under the best conditions. Then it is necessary to go and see the character of the rock and to have it dry for the masonry. Moreover, conditions may render the continued presence of workmen almost necessary. Such considerations have brought about a great development in pneumatic excavation. Compressed air is employed in the caisson, not to perform the digging operations but to exclude water. The possibility of doing this arises from the impenetrability of air and its ability to maintain a pressure against that of water. The general principle of the pneumatic caisson is to exclude water from entrance into a bottomless working chamber by compressed air, always at a tension equal to or slightly in excess of the hydrostatic pressure of the water at that level. The tension of free air at the earth's surface is equal to the weight upon it and averages at sea level 14.7 lb. per square inch. Below the water level 1 ft. a resistance per square inch in excess of this would have to be supplied equal to the weight of a column of water 1 ft. high and 1 sq. in. in cross section. As water weighs about 62 1-3 lb. per cubic foot, this excess tension will have to be 0.433 lb. per square inch. This, then, is the compression that will have to be effected. The tension required is 14.7 lb. more, as not only the water has to be supported but the weight of the atmosphere on the water. In compressing air, however, this one atmosphere is bad to start with, so that the gauge of the compressor which shows the actual compression discloses precisely the excess. The second foot of penetration below the water level will add another

0.433 lb. of compression required, and so on. To go 50 ft. below, the air compression would have to be 21.65 lb. per square inch, something less than 1½ atmospheres. A single atmosphere is added by going to a depth of 33.94 ft. (14.7÷0.433). Three atmospheres are about the limit of human endurance, so that the depth of 100 ft. is about as far down as it is practicable to go below the water level by pneumatic means. If a thoroughly impervious stratum is penetrated by the pneumatic caisson the excavation may sometimes be continued further by non-pneumatic methods, leaving the caisson behind; or, if the material in the stratum is not sufficiently impervious, the caisson may, at times, be left behind and the air pressure maintained. In the former case penetration below the three-atmosphere limit could be accomplished. As an example of the continuance of the air pressure subsequent to abandonment of the caisson, may be cited certain work done in sinking the foundation piers for the tower of the Singer Building. Quicksand had to be penetrated and for this the pneumatic caisson was employed. Between the lowest level of the quicksand and bed rock was a thick stratum of hard pan. After going into this stratum for, say, a foot or so, the caisson was left suspended, as it were, and the excavation continued on to bed rock. The air pressure was still maintained because of the permeability of the hard pan. It was sufficiently solid, however, to require no lateral support, which accounts for the possibility of leaving the caisson. Bed rock, at the corner of Liberty street and Broadway, New York, where the Singer Building is located, is about 90 ft. below the curb and about 75 ft. below the water level. The air pressure at the finish was consequently required to be somewhat in excess of 32 or 33 lb. per square inch.—Iron Age.

Friction.

What is friction really caused by? Why will two things in contact not slip over each other easily? It is because every substance known to science has teeth; microscopic, it is true, but still teeth. The result then is obvious. If we shove a book across a table, the teeth of the book interlock with the teeth of the table just as cogwheels do, and the push has to be strong enough either to bend them enough or to break them off for the motion to continue.

It has actually been observed in a microscope, though only recently, that if the push is only a slight one and moves the book only a short distance, on the pressure of the hand being removed the book actually jumps back to its former position. This action is a slight bending of the two sets of teeth, only not far enough for them to lose their relative positions, and their elasticity on being released makes the book fly back.

It has been shown that this friction is not so much between different bodies as between bodies of the same material. One industrial application of this is the bearings for steel axles. They are made of brass instead of steel.

In some things we want as much friction as possible and in others as little. The former is illustrated in the friction between an engine wheel and the track, sand sometimes being poured on the track to increase the friction. The latter case is illustrated in all bearings where rotating metal is in contact with stationary metal, sometimes ball bearings being substituted, thus lessening the friction.

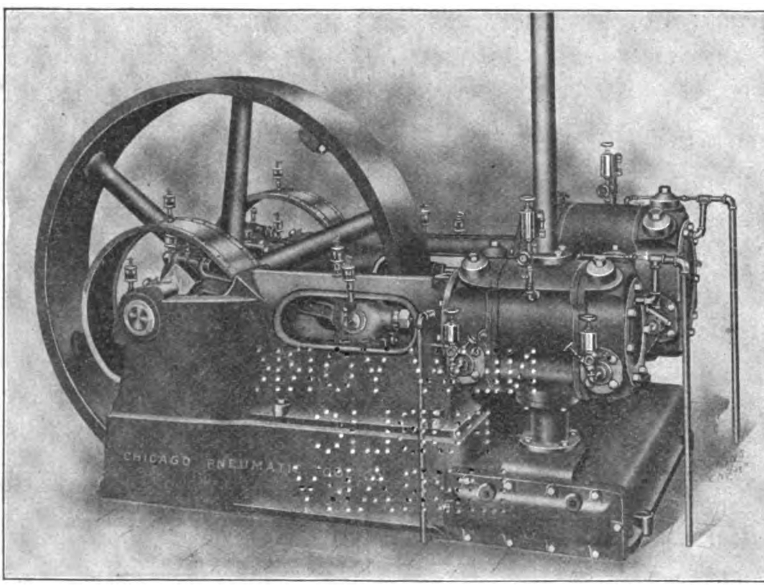
Many peculiar things would happen if there was no friction. All screws in wood would immediately twist backward rapidly and shoot out into the air; trains could not run save on cogged rails, which would probably be necessary above as well as below, thus having four rails instead of two; buildings would tumble down, and new ones could not be built unless molded in place like Edison's or else riveted together; people would have to wear shoes with long spikes in them, and then have to be careful, for dirt grains would slip over one another easily and would act like deep sand. But one great thing would happen, machines would run at one hundred per cent efficiency, would give out as much energy as was put into them.—Lawrence Hodges.

The Barker Dam at Boulder, Colo.

The *Contractor,* in an article descriptive of the construction of the Barker dam, an immense structure now being built near Boulder, Colo., says, in reference to the power used:

Three-phase alternating current to drive the compressors in this plant is delivered at 13,000 volts over a transmission line extending from a generating station, a distance of about 30 miles.

The compressor plant contains four motor-driven compressors, one with a capacity of 1,500 cubic feet of free air per minute, built by the Chicago Pneumatic Tool Company, and 3 Ingersoll-Rand machines, each having a capacity of 1,000 cubic feet of free air per minute. The large machine is belt-driven by two General Electric motors in tandem, one of the 150 horse-power and the other of 100 horse-power capacity, while each of the three smaller machines is belt-driven separately by a 150 horse-power General Electric motor. The compressors operate against a pressure of 80 to 100 pounds per square inch, an automatic unloading device being set to come into play at the latter pressure. The demands for power are such that all four machines are kept in service regularly, and usually for about 15 hours daily. The compressors deliver to three 4x10-foot receivers and 42-inch by 12-foot boiler used as a receiver, all of which are located outside the building containing the plant. Delivery pipe lines are extended from the latter down the side of the hill to the various plants below, one line being placed on the upstream and the other on the downstream of the dam. Branches from these lines reach each individual machine supplied. The receivers also are interconnected and arranged so part of the compressors can deliver to one line and the balance to the other, or all of them can supply both lines simultaneously.



Franklin Compressor—Type G-CB referred to.

Mean Effective Pressure in Air Compression

We reproduce on the opposite page, from a recent issue of the American Machinist, a diagram which, under all conditions which occur in the adiabatic compression of air affords the simplest means yet devised, or we might say, likely to be devised, for ascertaining the mean effective pressure in the cylinder for the entire operation, and from that, of course, also the horse power. The diagram was calculated and plotted by Mr. Ward Raymond, assistant chief engineer at the Phillipsburg plant of the Ingersoll-Rand Company.

The diagram is, of course, immediately and clearly intelligible to the trained engineer and to the well informed student, but we think that a word or two of explanation more than was given with the original publication of the diagram may make it available to a still larger number who are normally more expert in other lines.

The four curves of the diagram are, in fact, four separate portions of a single curve brought together upon a single sheet for compactness in publication rather than for convenience in use. The entire curve is shown on a much smaller scale in Fig. 1. The section lines in this cut correspond to the larger section lines only of the other diagram. In this cut all the figures indicating the lines are in regular sequence. In the large diagram the figures belong only to the curve nearest which they are located, and do not apply in any way to more than the one curve.

The diagram embodies the solution of the expression:

$$M\ E\ P = 3.46\ P_1\ (R^{0.29} - 1).$$

M E P refers to mean effective pressure developed in the air cylinder; P_1 is the absolute initial pressure, which in the case of an air compressor is usually atmospheric; *R* is the ratio of compression, or the absolute discharge pressure divided by the absolute initial pressure. Knowing the value of *R* from the conditions of the problem, we find directly from the diagram the corresponding value of the rest of the expression, namely, $3.46\ (R^{0.29} - 1)$, and multiplying this factor by the absolute initial pressure, gives at once the mean effective pressure. The four following examples will serve to show the simplicity of the operation:

1. Assume single-stage compression from the atmosphere to 60 pounds gage pressure. *R*, the ratio of compression, will be $(60 + 14.7) \div 14.7$, or $74.7 \div 14.7 = 5.08$. Examining the diagram we find that the vertical line marked *A* contains the value of $R = 5.08$. From the curve at this point we find that the value of the factor for which we are looking is 2.082. In the case of this problem the initial pressure is atmospheric, or 14.7 pounds per square inch absolute. Multiplying 2.082 by 14.7 we have a mean effective pressure developed in the air-compressor cylinder of 30.6 pounds per square inch, based on adiabatic compression. This is the true theoretical adiabatic *M E P* exerted against the piston and it is not necessary to deduct the back pressure from this as in the case of the usual steam formula.

In most compressed-air problems the mean effective pressure is not wanted so often as the indicated horsepower per 100 cubic feet piston displacement per minute, and in all cases this can be found by dividing the mean effective pressure by 2.29. For the case in point, dividing 30.6 by 2.29, we have 13.4 indicated horsepower developed in the air cylinder per 100 cubic feet of piston displacement per minute. Dividing this by 100 and multiplying by the piston displacement per minute of the compressor, we have the total indicated horsepower in the air cylinder in question.

Say that the compressor cylinder was 24 in. diameter by 30 in. stroke at 60 revolutions per minute; then the free air capacity would be:

$24^2 + 7854 + 5 + 60 \div 144 = 942$ cu. ft. per minute. Then $9.42 \times 13.4 = 126$ theoretical horsepower.

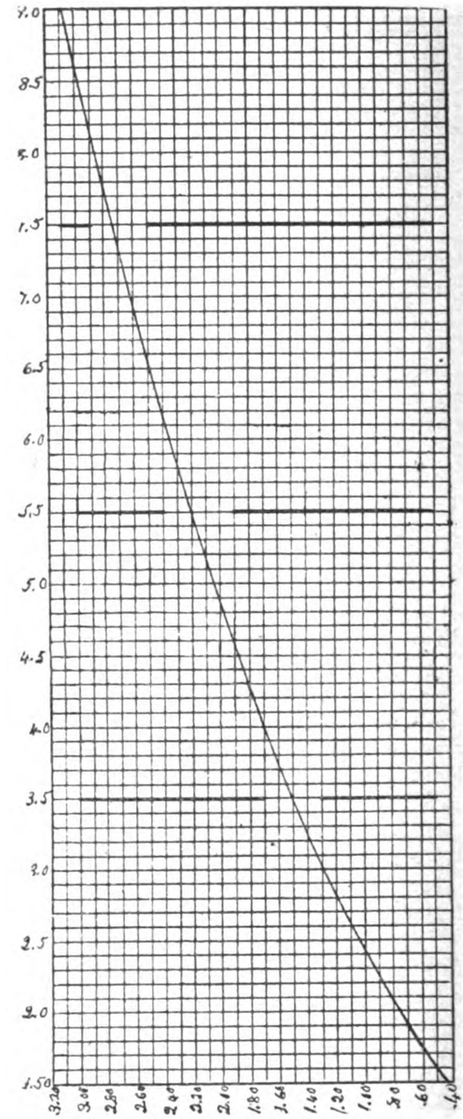
2. If the compression were single-stage from atmosphere to 100 pounds the value of R would be

$$114.7 \div 14.7 = 7.81.$$

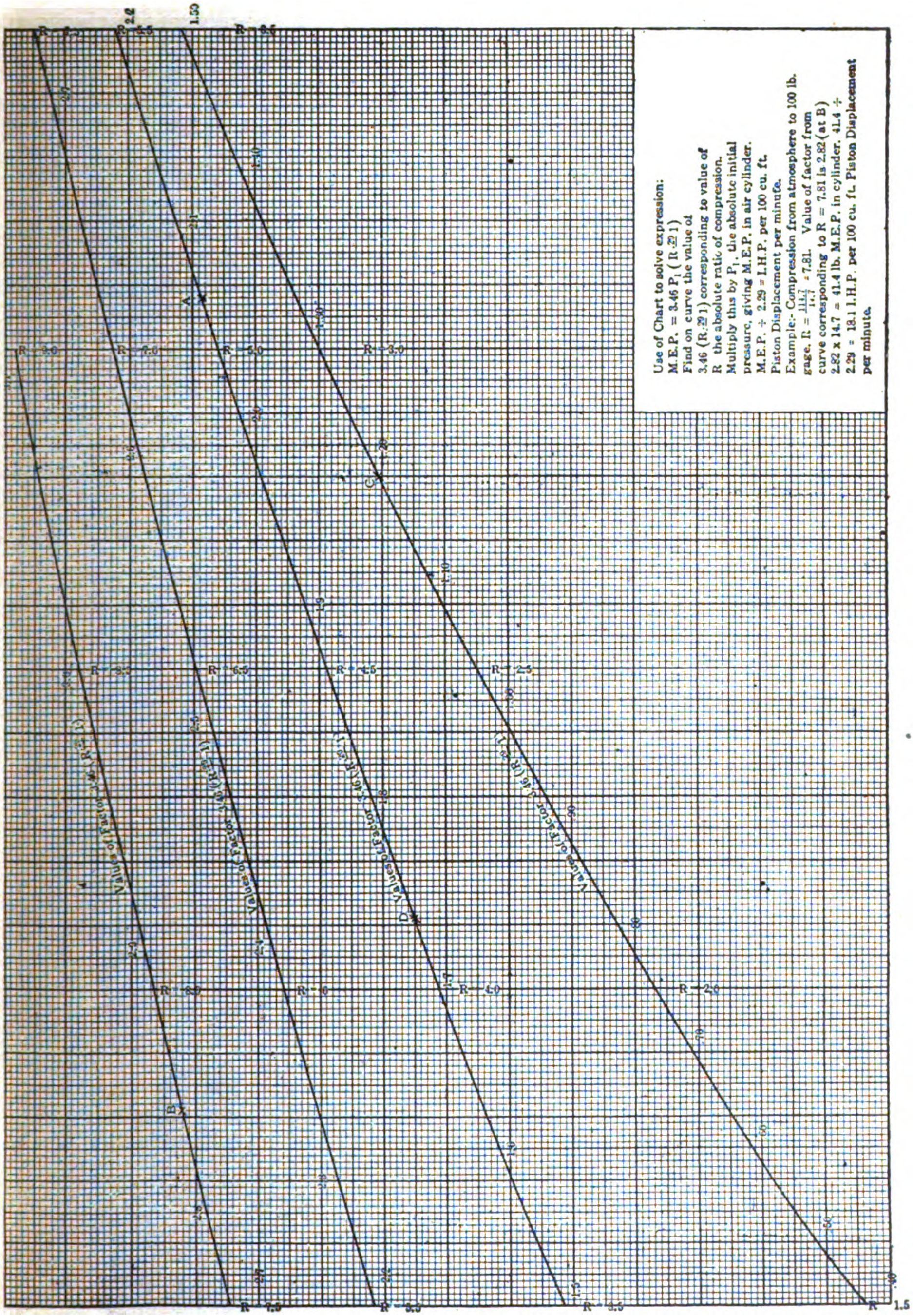
From the diagram we find that the vertical line containing $R = 7.81$, crosses the line of the diagram at the point marked B, corresponding to a factor value of 2.82. Multiplying this factor by the initial pressure 14.7 pounds, absolute, we have an answer of 41.4 pounds per square inch *M E P* developed in the air cylinder. Again, dividing this by 2.29 we have 18.1 indicated horsepower developed per 100 cubic feet of piston displacement per minute.

3. For compound compression we have only to remember that with theoretical conditions the horsepower of the low-pressure and the high-pressure cylinders should be alike, giving the minimum total power developed. In practice air compressors are designed so that this is approximately true. The curves and all the formulas are, of course, based on theoretical adiabatic compression, and therefore we are correct in assuming that the horsepowers in each of the two stages of compression are equal. If the horsepowers are equal this means that the ratios of compression in the two stages also are equal, and consequently the ratio of compression in each cylinder for compound compression will be the square root of the total ratio of compression.

From atmosphere to 100 pounds pressure we have already found that the total ratio of compression is 7.81. The square root of this, or the ratio of compression in either the low-pressure or the high-pressure cylinder, is 2.8. Entering the diagram we find that the line corresponding to the value of $R = 2.8$ crosses the factor line in the diagram at the point marked C and corresponds to the value of the factor 1.204. Multiplying 1.204 by the initial pressure 14.7, we have the mean effective pressure in the low-pressure cylinder 17.7 pounds per square inch. Dividing 17.7 by 2.29, we have the power in the low-pressure cylinder, 7.73 indicated horsepower per 100 cubic feet of displacement of this low-pressure cylinder. As this must be half of the total compressor horsepower of the compound compression, we have 15.46 indicated horsepower total for the two stages per 100 cubic feet of displacement per minute. Dividing this by 100 and multiplying the low-pressure cylinder displacement in cubic feet per minute we would have the total indicated horsepower of the compressor in question.



This process may be carried through



WARD RAYMOND'S CHART FOR DERIVING MEAN EFFECTIVE PRESSURES FOR ADIABATIC COMPRESSION OF AIR FROM ANY INTAKE PRESSURE

three, four, five, or any number of stages of compression. All that needs to be remembered is that for multiple-stage compression the horsepower in all the cylinders is supposed to be equal; therefore finding the horsepower in the low-pressure cylinder we can multiply this by the number of stages or cylinders, giving us the total horsepower of the compressor. In order that the horsepowers shall be equal, the ratios of compression in the various stages must be equal and consequently for compound compression, must be equal to the square root; for three-stage the cube root and for four-stage the fourth root of the total ratio of compression.

4. Assume three-stage compression to 1000 pounds pressure. The value of R, the ratio of compression, will be 1014.7 divided by 14.7 or 69.2 compressions. With equal horsepower in each stage the ratio of compression in each stage and consequently in the low-pressure cylinder, will be the cube root of 69.2, or 4.11, and in the diagram we have the value of 4.11 for R marked D. For this value of R the diagram gives us the factor 1.75. Multiplying 1.75 by 14.7 we have 25.7 pounds per square inch mean effective pressure in the low-pressure cylinder. Dividing this by 2.29 we have 11.22 indicated horsepower per 100 cubic feet per minute displacement of the low-pressure cylinder.

This is the horsepower in the first stage, also in each of the succeeding stages; consequently multiplying this figure by the number of stages, namely, three, we have a total horsepower for the compressor of 33.7 indicated horsepower per 100 cubic feet piston displacement of the low-pressure cylinder of the compressor per minute. This divided by 100 and multiplied by the piston displacement of the low-pressure cylinder per minute will give the total theoretical horsepower of the compressor.—*Compressed Air Magazine.*

Dishonesty and perpetual motion are in one class—only fools try to make them work.

Work grows interesting to the man who is doing his best to make it better.

AIR.

A very small word, but one indicating potentiality both destructive and creative beyond comprehension. Uncontrolled, its force and fury cannot be successfully opposed, but confined, it is made obedient to the will of man and will recreate what it has destroyed. Without its having been forced into control by the modern compressor, and put to practical use, the world's progress would have been very materially retarded and the approaching census would disclose the tillers of the ground in a vast majority—less wealth and an inactive state of affairs, greatly at variance with present conditions. Industries would have been checked and the wilderness would still exist where now are active and thriving centers of manufacturing. The wealth of the world would not have been increased, as the mines could not have been worked with the needed activity and results.

Progress is inevitable but the rapid progress that has characterized the present age would not have been possible without the pneumatic tools so extensively used today in the development of coal mines, the construction of the immense carriers of merchandise upon the seas, and the erection of the modern steel structures in our cities would have been impossible.

Truly, the riveting hammer has changed not only the skyline of the populated centers, but has demonstrated its vital importance and necessity in modern progress. The inventor of the "Boyer" hammer could not have foreseen the revolution it was destined to create in the world's affairs.

Electricity has played an equally important part, with its application to mechanical arts, and the progressive machine shop could not exist today without its air or electrically-driven drills and other tools and accessories.

The Chicago Pneumatic Tool Company was among the pioneers in this line of utilizing the elements and its catalogues are interesting and instructive to any man, even to the man whose thought of or interest in Air has not gone beyond the fact that he must have it in order to continue in existence.

The Motor Drive and Overtime

(Engineering Record)

Nowhere does the flexibility of the electric motor drive appear to better advantage than in shops where overtime work is frequent. The cost of operating all the main lines of shafting and belts, and, in many cases, of paying for the overtime services of the plant engineer as well, is not sufficiently often reduced to figures by central station managers seeking new power business. In even a moderate-size factory this cost may easily reach $400 or $500 a year. Such a sum will pay interest, depreciation, insurance and taxes on a pretty substantial equipment for grouped motor driving, but this is not the end of the matter. The equipment of individual and sub-departments with independent motive power electrically supplied tends to keep the rate of production inside efficient figures.

The convenience of the motor drive in sub-divided shops needs to be experienced to be appreciated. In a shop where a time-honored engine and shafting installation operates the machinery, the order for any portion of the factory to work overtime is a signal for the beginning of economic waste. The operation of an engine and boiler plant, from the feed pumps forward, depends for something like fair efficiency upon outputs within hailing distance of the capacities of the unit machines in the production chain. Hence when the greater part of the shop quits work, leaving a sub-department or relatively small percentage of the total connected installation to overtime operation, the generating and distributing plant begins to supply power at a load factor which places a premium on poor efficiency, raising the cost per hp.-hour delivered at the machine to a figure far above the normal expense of the service in the department. In many cases the losses due to underloaded operation and to the running of idle pulleys, belts and shafting, plus the losses in the larger mechanical plant needed for the power subdivision at the time, may amount to five or ten times the actual power requirements at the machinery which is running overtime.

When the department to be run overtime is provided with its own motors all this is changed. No matter where the power comes from originally, the rest of the shop is cut dead at the mere pulling of a switch. The transmission losses are then confined to a limited area instead of being spread over the entire factory. If the shop has its own plant one cannot escape some reductions in efficiency of power production by overtime service, but in many cases it becomes possible to shut down the larger machines and place in service one or two engines or generators of moderate capacity, which will run at better economy than the equipment which usually handles the entire plant. With an ordinary shafting and belt-driven installation, it is out of the question to shut down the larger prime movers to carry a small load at a remote point, on account of the proportion of the friction losses to the machine demands, even under the most favorable conditions.

In the department working overtime the motor drive supplies steady and compactly applied power, with regulation as good as when the whole mill is in operation. Under the conditions of electrical distribution the overtime work becomes independent; the absence of long mechanical transmissions is beneficial; and no time is lost in the adjustment of the supply system to the conditions of small load. The installation of central station service for driving departments liable to do a good deal of night work is a first-class initial move toward the equipment of the complete factory with electric power. The cost of overtime work to the manufacturer is always relatively high, and anything which can be done to reduce it, even on a comparatively small scale, is generally well worth while.—Engineering Record.

IDEAL POWER

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Send 25 cents and have your name put on our subscription list.

Volume Seven.

The present issue of IDEAL POWER commences the seventh year of its publication, which will be continued in the interests of Compressed Air and Electric Appliances, subjects which are commanding rapidly increasing attention and recognized as of leading importance in the manufacturing world.

We hope to place before our readers many items of interest and value in this seventh volume.

A most gratifying improvement and activity in construction and manufacturing circles is indicated by the orders received by the Chicago Pneumatic Tool Company for the pneumatic and electrical devices of its manufacture. Each of its plants is running full capacity and the amount and number of its orders was never greater in the company's history, indicating their continued popularity and approval.

The Browning Engineering Company of Cleveland, O., whose advertisement appears on page 28 are frequently called upon to furnish good operators for their locomotive cranes and are always on the lookout for competent men for this service. They will be glad to consider applications from men with this fitness, for prompt or future reference.

Satiety is the pessimism of society.

Detroit Industrial Exposition.

Under the auspices of its Board of Commerce the city of Detroit, Mich., is to hold an Industrial Exposition, June 20 to July 6, at which not only the products of the Detroit factories will be shown, but the processes. The exposition has been planned on a liberal scale and there is no reason why it should not be a great success, both in the line of education and entertainment, for the diversity of represented industries and the location of the grounds must serve to make it such.

C. P. T JUNIORS.

It was to be expected, for nothing ever came from the Detroit shops of the Chicago Pneumatic Tool Co. (where the hammers, etc., are made), that had to take second place, either product or producers.

A year ago we chronicled the victory of the basket ball team, formed from the Company's employes in the Detroit plant, which won every league game during the season, becoming the champions of the Manufacturers' League.

This year it is the "C. P. T. Juniors" who are jubilant for a like reason, having met with but a single defeat in the fifteen games played and redeeming this lapse by a final total score of nearly double that of their opponents.

The closing game of the season was with their neighbors, the Burroughs Y. M. C., a particularly strong team, much heavier than the C. P. T. Juniors, who offset this by their splendid team work, winning 33 to 22.

We are pleased to present a picture of this team which has so well maintained the reputation of the company outside of the works as well as inside.

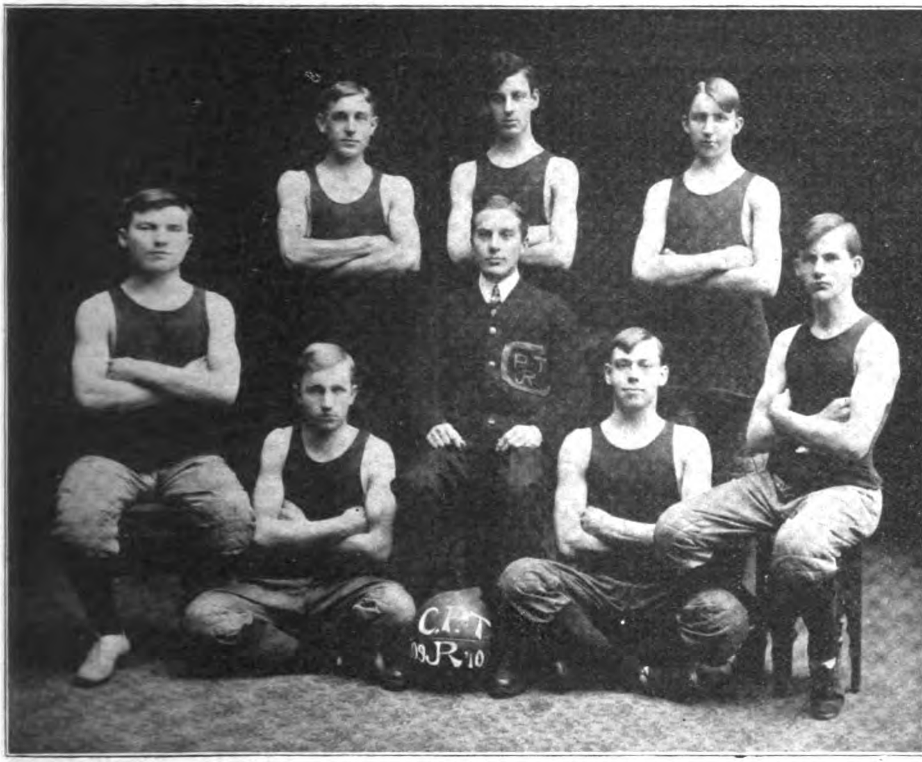
Top Row—Left to right. Weiss (guard), Sutherland and Petrowski (centers).

Second Row—Shaughnessy (forward), Reid (coach), Corrigan (sub.).

Lower Row—Fuchs (forward), W. Brain, guard captain.

Hume and Harrison are out of the picture owing to sickness.

Rusting is the poorest way of resting.



C. P. T. Juniors—Basket Ball Team.

The Ubiquitous Electric Motor.

Before the advent of the electric motor, a breakdown of the main engine of a mill or factory was usually a matter of serious consequence, often causing a complete tie-up of the whole works for several months until the necessary repairs could be made. It is pleasing, therefore, to be able to record a case in which a stoppage of probably from five to six months for repairs to a mill engine was cut down to a little over a week by the substitution of electric drive for the mechanical drive previously used.

The instance in question is reported from England. It appears that the main driving engine of the mills of Marshall, Kaye & Marshall at Ravensthorpe, in the county of Yorkshire, recently suffered a serious breakdown, and the directors of the company were quick to appreciate the facility with which electric motors could be installed for driving their machinery. Accordingly, the transformation to electric drive was commenced immediately after the accident with the result that the machinery in practically all of the various departments was able to be restarted in less than ten days after the breakdown. Electric power for the motors is taken from the mains of the Yorkshire Electric Power Company, the total amount needed being in the neighborhood of 400 horse-power.

The quickness with which the change-over was effected was quite a feat in engineering, and reflects great credit on all the parties concerned. Thus was another convert obtained to electric drive, and it does not seem likely that the new order of things will now be changed in this particular case. The moral is obvious, and much notice will be paid it by owners of steam-driven plants.—Electrical Review and Western Electrician.

Shop Torque.

"You make too much noise with that everlasting chatter. You're full of wind," said the Little Giant Drill to the Boyer Hammer.

"Well," replied the Hammer, "I'm not such a bore as you are."

"Anyhow," retorted the Little Giant, "I get through things quickly and don't make any noise about it."

Then the whistle blew.

You Can't Lose 'Em.

A letter recently mailed in France, addressed to

Sirs Boyer Hammers,
Westminster,
London,

was promptly delivered at its intended destination, the London offices of the Chicago Pneumatic Tool Co.

Cautious.

J. M. Barrie says: "We Scots abhor waste. Did you never hear of the aged Saunders Carlyle, who always drank off his whiskey to the last drop the instant it was poured out for him?"

"'Why do you drink down your liquor in that quick, greedy way?' a stranger said to Saunders in a reproachful tone.

"'I once had one knocked over,' the old man explained."

Up from the D: pths.

"Now, Johnny," asked the gentleman who had kindly consented to teach the class, "what does this fascinating story of Jonah and the whale teach us?"

"It teaches us,' said Johnny, "that you cannot keep a good man down."

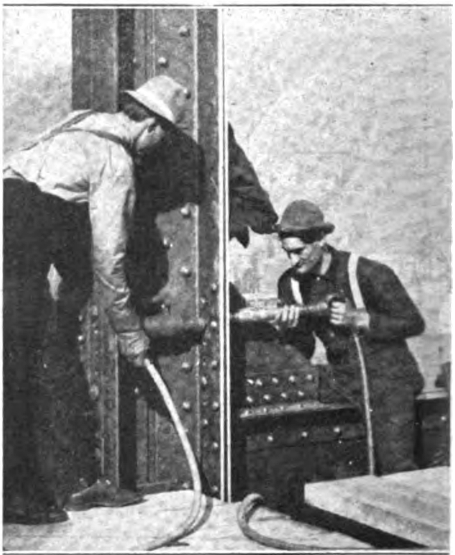
The Real Reason.

"And you wouldn't begin a journey on Friday?"

"You bet I wouldn't."

"I can't understand how you can have any faith in such a silly superstition."

"No superstitution about it. Saturday's payday."



"UP IN THE WORLD."

The "Boyer" Long Stroke Riveting Hammer in operation on the 'steenth floor of a modern sky scraper.

Patrick arrived home much the worse for wear. One eye was closed, his nose was broken, and his face looked as though it had been stung by bees.

"Glory be!" exclaimed his wife.

"Thot Dutchman, Schwartzheimer—'twas him," explained Patrick.

"Shame on ye!" exploded his wife, without sympathy. "A big shpalpeen the loikes of you to get beat up by a little omadhoun of a Dutchman the size of him! Why——"

"Whist, Norah," said Patrick, "don't spake disrespectfully of the dead."

One day an Irishman was asked to come to work an hour earlier than usual. This he promised to do. Next morning he was an hour late.

"Sure, sor, I should have been no good if Oi'd come, as I was fast asleep."

Boss: "To carry a lighted candle into the magazine I should think would be the last thing Murphy would do!"

Casey: "It was, sor!"

The Englishman on the Continent

The boarding-house.	Die Pension.	Dee Pang-see-ong.
The landlady.	Die Zimmervermie-terin.	Dee Tzimmer-fer-mee-ter-in.
Good day, Madam, have you a furnished room to let?	Guten Tag, Madame, haben sie ein möblirtes Zimmer zu vermieten?	Goo-ten Tah-ch, Mah-dahm, hahben Zee eye-n ma-bleertes Tzimmer tzoo fer-mee-ten?
Yes Sir, please step in.	Ja, mein Herr, treten Sie bitte, ein.	Yah, mine Herr, tray-ten Zee bitta, eye-n.
I will stay here for some time; how much do you charge for the room per month, per week, per day.	Ich will einige Zeit hierbleiben; wieviel berechnen Sie das Zimmer pro Monat, pro Woche, pro Tag.	Eech vill eye-nigg-a Tzeit here-bly-ben; vee-feel bey-rech-nen Zee dahs Tzimmer pro Mo-naht, pro Voh-ch-a, pro Tah-gk.
Is light and attendance included?	Ist Licht und Bedienung inbegriffen?	Isst Lee-chtt oond Bey-dee-nuhng in-bey-griff-en?
I wish to have coffee in the morning.	Ich wünsche morgens Kaffee zu haben.	Eech vuen-sha mor-gens Cahff-ee tzoo hah-ben.
Tea, ham, rolls and two eggs.	Thee, Schinken, Semmel und zwei Eier.	Tay, Shing-ken, Zem-mel oond tzvy Eye-er.
How much is it?	Wieviel kostet das?	Vee-feel costet dahs?
I wish to have full board.	Ich will vollständige Pension haben.	Eech vill fol-stend-eega Pang-see-ong hah-ben.
Do you talk English, Madam?	Sprechen Sie Englisch, Madam?	Shpresh-en Zee Eng-lee-ch Mah-dahm?
No sir.	Nein, mein Herr.	Nine, mine Herr.
That is very good, in this way I will learn German better.	Das ist sehr gut, auf diese Weise werde ich besser Deutsch lernen.	Dahs isst sayr goodt, ow-f dees-a Vye-sa verd-a eech bess-er Doytsh layr-nen.
Will you give me a key, please.	Wollen Sie mir bitte, einen Schlüssel geben	Vollen Zee meer bitta eye-nen Shless-el gay-ben.
At what time will the door be shut?	Um welche Stunde wird die Thüre geschlossen?	Oom vel-cha Shtoon-da veerd dee Teer-a gey-shloss-en?
At ten o'clock, Sir.	Um Zehn Uhr, mein Herr.	Oom Tzayn Oo-hr, mine Herr.
Allright.	Gut.	Goodt.
I will come home late.	Ich werde spät nach Hause kommen.	Eech verd-a shpay-tt nah-gk How-ss-a komm-en.
Will you awake me at eight o'clock in the morning.	Wollen Sie mich morgen früh um acht Uhr wecken.	Vollen Zee meech mor-gen free oom ah-chtt Oo-hrveck-en.

The German Bar.	Die Deutsche Bierhalle.	Dee Doyt-sha Beerhahl-a.
Waiter!	Kellner!	Kellner!
A glass of beer, please.	Ein Glas Bier, bitte.	Eye-n Glah-ss Beer, bitta.
What kind of beer would you like, Sir?	Was für eine Sorte Bier Wünschen Sie?	Vas fear eye-na Sort-a Beer vun-shen Zee?
Bring a bottle of English beer.	Bringen Sie eine Flasche Englisches Bier.	Bring-en Zee eye-na Flah-sha Eng-lee--ches Beer.
A tankard of Munich beer.	Ein Krug Münchener Bier.	Eye-n Crew-gk Mean--chen-ar Beer.
A pint of Bavarian beer.	Eien Seidel Bayrisches Bier.	Eye-n Sigh-del Buyer--ree-ches Beer.
What will you have to drink?	Was trinken Sie?	Vahs trink-en Zee?
Please, show me the wine-card.	Bitte, zeigen Sie mir die Weinkarte.	Bitta, tz-eye-gen Zee meer dee Vine-cart-a.
Bring us one, two, three, four glasses.	Bringen Sie uns eins, zwei, drei, vier Gläser.	Bring-en Zee oons ein-s, tzvy, drry, fear Glay-ser.
Open the bottle, please.	Offnen Sie die Flasche, bitte.	Oeffnen Zee dee Flah-sha, bitta.
Say, waiter, what have you got to eat?	Sagen Sie, Kellner, was haben Sie zu essen?	Sah-gen Zee, Kellner, vahs hahben Zee tzu essen?
Give me the bill of fare.	Geben Sie mir die Speisekarte.	Gay-ben Zee meer dee Shpy-sa-cart-a.
Pork feet and pickled cabbage, with fried potatoes.	Schweinefüsse mit Sauerkraut, mit Bratkartoffeln.	Shvine-a-feess-a mitt Zour-krowt, mitt Brah-t-kar-toff-eln.
I wish to have some sandwiches,	Ich möchte belegte Brödchen haben,	Eech machtta bey-lay-cht-a Brad-chen hah-ben,
with ham,	mit Schinken,	mitt Shing-ken,
boiled ham,	gekochter Schinken,	gey-koh-cht-ter Shing-ken,
with cheese,	mit Käse,	mitt Kay-sa,
with sausage,	mit Wurst,	mitt Voorstt,
liver sausage,	Leberwurst,	Lay-ber-voorstt,
meat sausage,	Fleischwurst,	Fly-sh-voorstt,
with roast,	mit Braten,	mitt Brah-ten,
with cold roast beef.	mit kaltem Rostbeef.	mitt kahl-tem Rost-beef.
Give us another bottle of beer.	Geben Sie uns noch eine Flasche Bier.	Gay-ben Zee oons noch eye-na Flah-sha Beer.
How much do I owe you?	Wieviel bin ich Ihnen schuldig?	Vee-feel binn eech Eenen shoo-ld-eech?
Please, change this piece of money.	Bitte, wechseln Sie dies Geldstück.	Bitta, weck-seln Zee dees Geld-shtueck.
Here is your tip.	Hier ist Ihr Trinkgeld.	Here isst Ee-er Trink--geld.
	Danke Ihmen, mein	

Optimism is life. Pessimism slow suicide.

Life is a conundrum that few of us care to give up.

Some people would rather pick flaws than strawberries.

A woman's tears scare a man more than they hurt him.

Good manners will tend to make any man attractive.

It takes a long time to get rich by earning your money.

Anger wrecks nerves and later becomes a chronic disease.

Get a move on you in the right direction, then keep going.

You do not boost the next world by knocking this one.

Some people are respectable in spite of what the neighbors say.

Misery loves company, but remember it loves cheerful company.

The road to success: Turn to the right and go straight ahead.

Adam raised Cain, but he didn't do business with the sugar trust.

The man who is thoroughly satisfied with himself isn't with anything else.

When there is a ghost of a chance never give up until you give up the ghost.

No blunder in business is quite as bad as not determining the cost of production.

Down with the egg trust! Set out an egg plant in your back yard this spring.

Show a disposition to be an easy mark and everybody will help you make good.

The "good fellow" reputation which depends upon the bottle vanishes as quickly as the liquor.

Human nature is quick to respond to either good or bad treatment. I find it is a good investment to meet people half way.

There ought to be more memory schools where they teach the ability to remember what we owe to others.

It is almost as easy to do good work as poor work after you once learn how, and much more profitable.

A business affair is of importance only when a dollar is expended, or saved, or made.

A mixture of Suspicion, Misunderstanding and Mistaken Pride forms a poison fatal to happiness. The best antidote is mutual explanation.

Concentration is the principle of accomplishment. I am giving this as a tip to you if you have more to do than you can possibly get done.

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ROCK DRILLS

The Chicago GIANT

ON TRIPOD or COLUMN MOUNTINGS.

Give a maximum of duty at a minimum of expense.

BABY GIANT

ONE-MAN DRILL.

Will do a wonderful amount of work at a surprisingly small expense for power, labor and repairs.

Our Descriptive Catalogs are at your command.

Manufactured by

Chicago Pneumatic Tool Company

CHICAGO NEW YORK

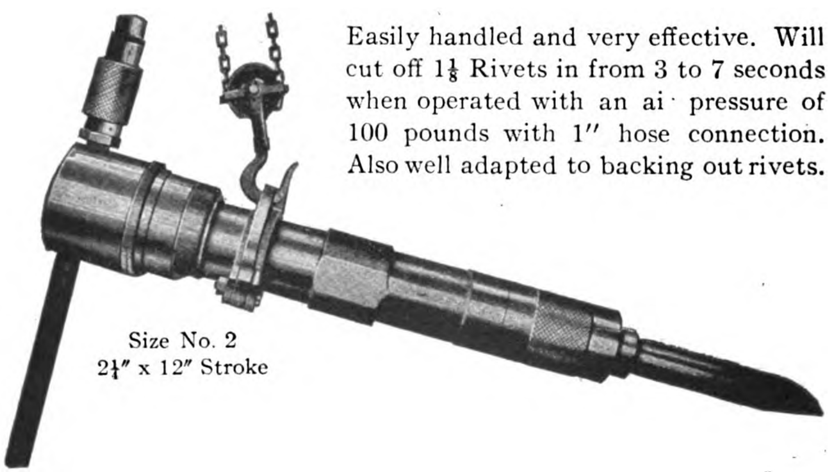
Little Giant

Boyer

RIVET BUSTER

For Cutting off Rivets in Structural Iron, Steel Cars, Locomotives, Mud-ring Rivets, Side-sheet Rivets, Breaking Stay-bolts, as well as all similar work pertaining to Steel Bridges and Scrap Yards.

Easily handled and very effective. Will cut off $1\frac{1}{8}$ Rivets in from 3 to 7 seconds when operated with an air pressure of 100 pounds with 1″ hose connection. Also well adapted to backing out rivets.



Size No. 2
$2\frac{1}{4}$″ x 12″ Stroke

Weight, without chisel	124 lbs.	Length of chisel shank	4″
Weight, with chisel	136 lbs.	Length over all (with chisel)	40″
Diameter of chisel shank	$2\frac{5}{16}$″	Blows per minute at 100 lbs. air pressure	360

This tool is fitted with the M. S. Retainer, preventing the shooting out of piston or chisel. In general design it is patterned after the well known Boyer Riveting Hammer.

Manufactured by

Chicago Pneumatic Tool Company

CHICAGO NEW YORK

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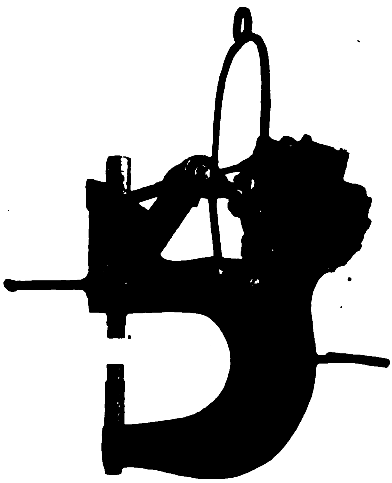
"Boyer" "Keller"

RIVETERS

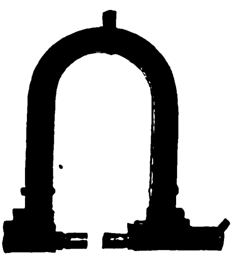
New Chicago Compression

REACH
From 12″ to 45″

GAP (Height)
From 16″ to 20″

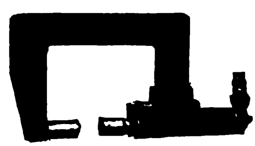


Suitable for
RIVETS
1″ to 1¼″



YOKE RIVETERS

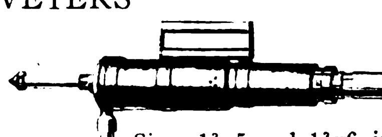
As shown in illustrations, these machines may be fitted to either pipe yoke or flat forged frames, as desired. The Standard Pipe Yoke has 15-inch gap and 30-inch reach. Other size yokes as ordered.



Size 1¾ x 6
for ¾, ⅞ and 1″ rivets.

JAM RIVETERS

Size 1¾ x 3⅞
inches



Sizes 1¾x5 and 1¾x6 inches

With wood handles, and arranged for use with or without extension or tail piece. Particularly adapted for riveting between channels on ship or structural work, and also for flue expanding and crown sheet cleaning on locomotives. Made in three sizes.

Manufactured by

Chicago Pneumatic Tool Co.

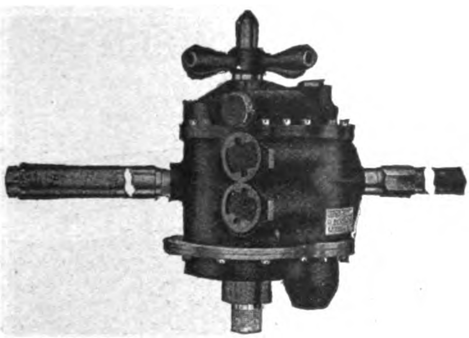
CHICAGO NEW YORK

"Duntley" "Little Giant"

"Little Giant"

AIR DRILLS

STRONG
DURABLE



RELIABLE
EFFICIENT

BUILT IN
ALL SIZES

Reversible and
Non-Reversible

SENT
ON TRIAL
ANYWHERE

STANDARD
THE WORLD
OVER

LITTLE GIANT
SIZE AC

Can be fitted with Breast Plate and any style chuck specified. Two speeds—1700 and 850 r p. m.

WRITE FOR
COMPLETE
CATALOGUE

SIZE CW

Little Giant Wood Boring Machine. Weight 30 pounds, capacity 4 inches, speed 220 r. p. m. Throttle and reverse valves are self-seating—therefore, no amount of wear will cause them to leak. The latest types have been improved and simplified to more perfectly meet the conditions in all modern industrial plants.

Manufactured by

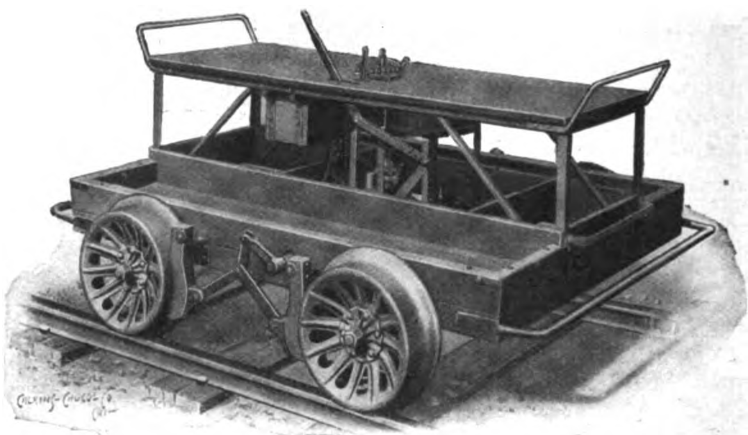
Chicago Pneumatic Tool Company

CHICAGO NEW YORK

"Rockford"

GASOLINE MOTOR CARS

FOR RAILWAY SERVICE



No. 4 Rockford Section Car

The "Rockford" Railway Section and Inspection Motor Cars have already demonstrated their merits to Section Men, Signal Maintainers and Inspectors in Economy of Maintenance of Way Service, and have received the highest commendation.

They effect a saving of time and conservation of energy.

They combine Simplicity, Durability and Reliability with Low Operating Cost.

Speed is easily controlled at from two to forty miles per hour. They are quickly and easily removed from the rails.

Correspondence with Railroads and their closest investigation is solicited.

MANUFACTURED BY

CHICAGO PNEUMATIC TOOL CO.

CHICAGO NEW YORK

A DAMAGING CONFESSION

When a woman says: "Thank Heaven, I'm through with my spring housecleaning," she makes a mortifying confession.

She admits that for twelve months she allowed her house to grow dirtier, month by month, until it became just twelve times as dirty as it should have been.

What excuse does she offer? Why do this thing only once or twice a year?

Because of the confusion, the misery, the worry it causes.

"House-cleaning time!" Who does not shudder to think of it?

A well-known domestic science authority said the other day:

> "The Duntley Cleaner is the greatest household invention since the sewing machine. It does more to lighten housework and to make the home sanitary than any other one thing."

The Duntley Pneumatic Cleaner transforms the care of home from an infinite burden into a comparative pleasure.

Instead of an upheaval of furniture, ripping up of carpets, and what not, to get rid of the accumulated dirt of months, we have a regular and simple renovation which results in perpetual freedom from dust, grime and disease germs.

You need never sweep nor dust again. The Duntley Pneumatic Cleaner will do it for you—ten times easier, ten times quicker and ten times better.

I know so well that the Duntley Cleaner will free you forever from the housecleaning bugbear, that I am willing to send you a machine for a free demonstration in your own home, no matter where you live.

I am not afraid to send the Duntley Pneumatic Cleaner a thousand miles away and let it tell its own story.

I want you to know why this cleaner has won grand prizes in this country and Gold Medals abroad. I want you to realize that it is cheaper to have a Duntley Pneumatic Cleaner than to be without one.

Let me prove what I claim—in your own home. I will take all the risk. If you do not find that the Duntley Cleaner is an actual household necessity, send it back.

Duntley Pneumatic Cleaners are operated by the ordinary electric light current. Where there is no electricity, hand-power machines can be furnished.

Prices range from $45.00 to $125.00. Small monthly payments, when desired.

Fill out and mail me today the coupon below.

J. W. Duntley, Pres. **Harvester Building, Chicago**

Cut on This Line and Mail Coupon at Once

DUNTLEY MANUFACTURING CO., 404 Harvester Bldg., Chicago.

Send me booklet of Duntley Pneumatic Cleaners for household use, and your book on scientific housecleaning.

Name______________________________

Address____________________________

Town________________ State____________

Vol. 7. MAY, 1910. No. 2.

IDEAL POWER

A MONTHLY MAGAZINE

DEVOTED TO COMPRESSED AIR AND ELECTRICAL APPLIANCES

The Chicago Pneumatic Tool Co.'s
Commercial Automobile

Is Rapidly
Taking Its Proper Place
IN THE FRONT

See Page 51.

WRITE FOR FULL INFORMATION

Chicago Pneumatic Tool Company

CHICAGO :: NEW YORK

CALKINS-CHOCOL ENG. CO.-CHI

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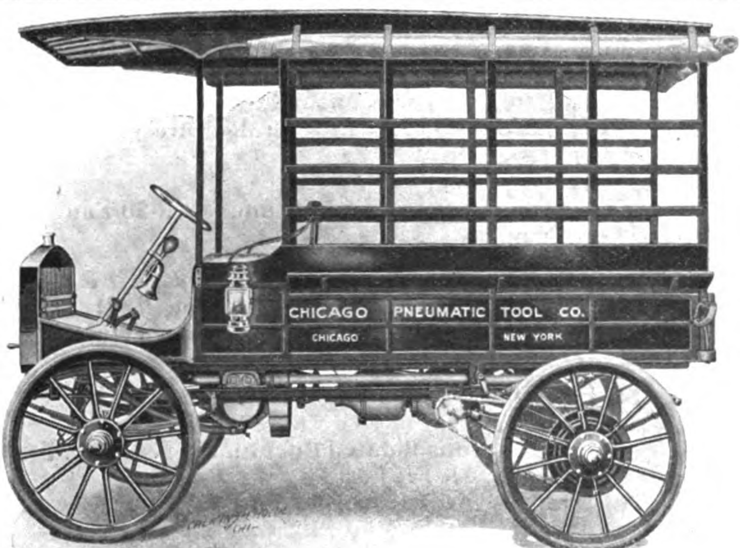

See Page 79.

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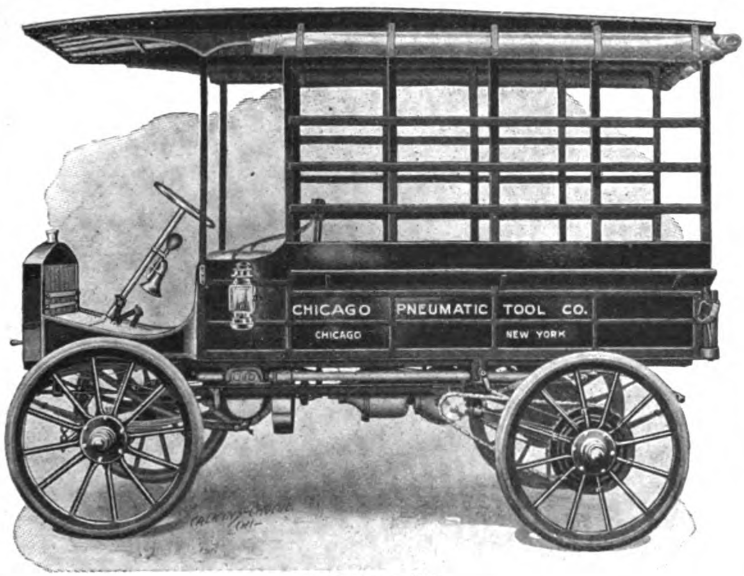

See Page 107.

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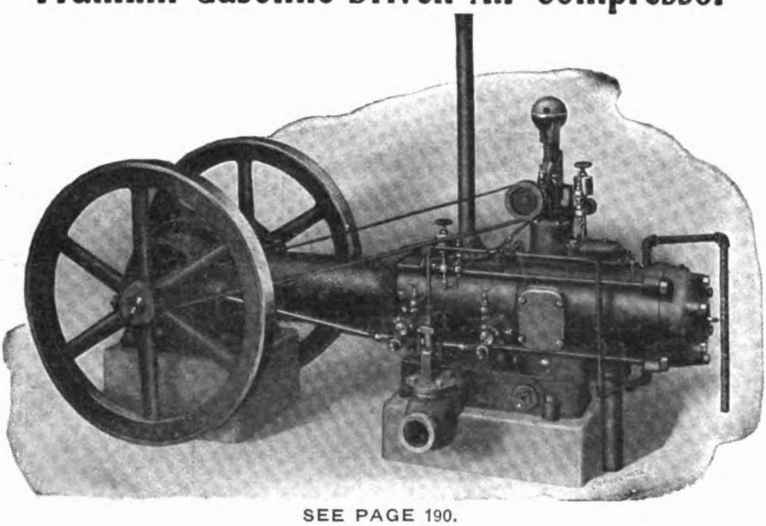
DEVOTED TO COMPRESSED AIR AND ELECTRICAL APPLIANCES

Franklin Gasoline-Driven Air Compressor



SEE PAGE 190.

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A MONTHLY MAGAZINE

DEVOTED TO COMPRESSED AIR AND ELECTRICAL APPLIANCES

The Chicago Pneumatic Tool Co. Extends to its Friends and Patrons Best Wishes and Heartiest Greetings for Christmas and The New Year

WRITE FOR FULL INFORMATION

Chicago Pneumatic Tool Company

CHICAGO :: NEW YORK

CALKINS-CHOCOL ENG. CO. CHI.

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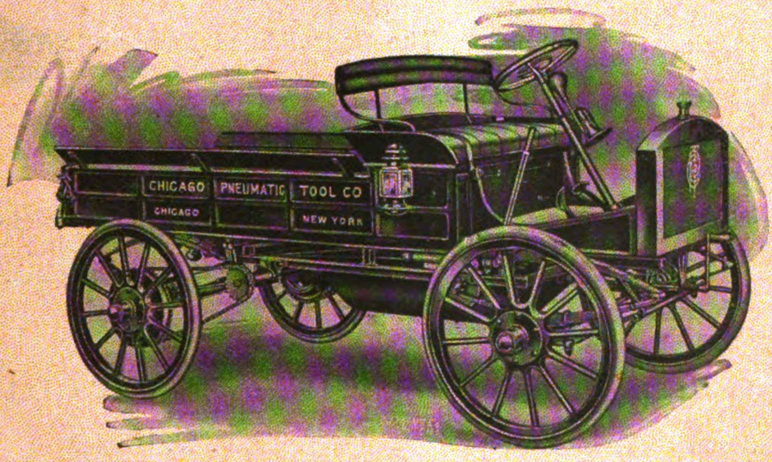

"LITTLE GIANT" COMMERCIAL CAR.
Built by Chicago Pneumatic Tool Co.

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